



Initial Review  
**BOX AF**

300-120 8/11

**PATENT**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:  
Thackeray *et al.*

Serial No.: 08/206,792

Filed: April 1, 1994

For: ELECTROCHEMICAL CELL

Group Art Unit: 1111

Examiner: M. Nuzzolillo

Atty. Dkt. No.: ADAA:105/WIM

**RECEIVED**

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37 C.F.R. 1.8	
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I hereby certify that this correspondence is being deposited with the U.S. Postal Service as First Class Mail in an envelope addressed to: Assistant Commissioner for Patents, Washington, D.C. 20231, on the date below:	
May 16, 1997	
Date	Mark B. Wilson

**APPEAL BRIEF**

**BOX AF**

Assistant Commissioner of Patents  
Washington, D.C. 20231

Sir:

Applicant hereby submits an original and two copies of this Appeal Brief to the Board of Patent Appeals and Interferences in response to the final Office Action dated September 16, 1996. The fee for filing this Appeal Brief is \$300, and is included in the check attached hereto. The Notice of Appeal was filed in the present case on December 16, 1996.

A request for a 3 month extension of time to respond is included herewith. The extension fee is included in the attached check. This 3 month extension will bring the due date to May 16, 1997. Should such request or fee be deficient or absent, consider this paragraph such a request and authorization to withdraw the appropriate fee.

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If the check is inadvertently omitted, or should any additional fees under 37 C.F.R. §§ 1.16 to 1.21 be required for any reason relating to the enclosed material, or should an overpayment be included herein, the Commissioner is authorized to deduct or credit said fees from or to Arnold, White & Durkee Deposit Account No. 01-2508/ADAA:105/WIM.

**I. REAL PARTY IN INTEREST**

The real party in interest is the Assignee Technology Finance Corporation (Propriety) Limited, 2nd Floor, Finance Week House, 172 Grayston Drive, Sandton, Transvaal Province, Republic of South Africa.

**II. RELATED APPEALS AND INTERFERENCES**

Appellants know of no related appeals or interferences.

**III. STATUS OF THE CLAIMS**

Claims 1 and 3-20 are currently pending. All claims stand rejected and are the subject of this appeal. A copy of the currently pending claims is attached hereto as Appendix A.

**IV. STATUS OF AMENDMENTS**

Appellants have provided no amendments after receipt of the final Office Action.

**V. SUMMARY OF THE INVENTION**

The present invention is drawn to an electrochemical cell comprising an anode, cathode and electrolyte. At least part of the anode of the electrochemical cell of the invention is a lithium transition metal oxide compound having a  $[B_2]X_4^{n-}$  spinel-type framework structure of an  $A[B_2]X_4$  spinel, where A and B are metal cations, X is oxygen (O), and n- refers to the overall

charge of the structural unit  $[B_2]X_4$  of the framework structure (page 2, lines 4-12). At least part of the cathode of the electrochemical cell of the invention comprises a lithium metal oxide compound (page 2, lines 13-14). The electrolyte of the electrochemical cell of the invention typically contains an electrically insulative lithium containing liquid or polymeric electronically conductive electrolyte. The electrolyte is located between the anode and the cathode, such that, on discharging the cell, lithium ions are extracted from the spinel-type framework structure of the anode, with the oxidation state of the metal ions of the anode thereby increasing, while a concomitant insertion of lithium ions into the compound of the cathode takes place, with the oxidation state of the metal ions of the cathode decreasing correspondingly (page 2, line 15 to page 3, line 6). Thus, the invention provides "rocking chair" rechargeable lithium cells in which lithium ions are transported between the two transition metal oxide electrodes, the anode of which has a spinel-type structure (page 18, lines 3-9).

## **VI. ISSUES ON APPEAL**

1. Are claims 1, 3-4, 7-15 and 18-20 obvious over Thackeray *et al.* 4,507,371?
2. Are claims 1, 3-4, and 7-20 obvious over Thackeray 4,980,251?
3. Are claims 1 and 3-20 obvious over Thackeray 5,316,877?

## **VII. GROUPING OF THE CLAIMS**

For purposes of the rejection based on Thackeray *et al.* 4,507,371 (the '371 patent), claims 5, 6, 16 and 17 will stand or fall separately. These claims were not rejected over the '371 patent and, therefore, will not be affected by the arguments relating to the rejection of the remaining claims.

For purposes of the rejection based on Thackeray 4,980,251 (the '251 patent), claims 5 and 6 will stand or fall separately. Claims 5 and 6 were not subject to the rejection based on the '251 patent and, therefore, will not be affected by the arguments relating to the rejection of the remaining claims.

For purposes of the rejection based on Thackeray 5,316,877 (the '877 patent), all claims stand or fall together.

## VIII. ARGUMENT

### A. General Comments to Rejections Under 35 U.S.C. § 103

In assessing the prior art relied on by the Examiner, it is helpful to bear in mind that Claim 1 is directed to an electrochemical cell comprising a combination of the following features:

- (i) As at least part of the anode, a lithium transition metal oxide compound which has a  $[B_2]X_4^{n-}$  spinel type framework structure of an  $A[B_2]X_4$  spinel, etc.;
- (ii) As at least part of the cathode, a (solid) lithium metal oxide compound;
- (iii) An electrically insulative lithium containing liquid or polymeric ionically conductive electrolyte between the anode and the cathode;
- (iv) The anode, cathode and electrolyte being such that the mechanism of the cell exhibits a "rocking chair" effect, wherein on discharge, lithium ions are extracted from the spinel type framework structure of the anode, with the oxidation state of the metal ions of the anode thereby increasing, while a concomitant insertion of lithium ions into the compound of the cathode takes place, with the oxidation state of the metal ions of the cathode decreasing correspondingly.

In this regard, see also page 18, lines 5 to 9 of the specification.

Appellants initially point out that determining obviousness requires an analysis of the invention *as a whole*. *Gillette Co. v. S.C. Johnson & Son, Inc.*, 919 F.2d 720, 724 (Fed. Cir. 1990). Significantly, *Gillette* emphasizes that whether all of the elements of the claimed invention were old in other contexts is immaterial to the issue of obviousness. Rather, "*what must be found obvious to defeat the patent is the claimed combination.*" *Id.* (quoting *Kimberly-Clark Corp. v. Johnson & Johnson*, 745 F.2d 1437, 1448, 223 U.S.P.Q. 603, 609-10 (Fed. Cir. 1984)) (emphasis in original).

It is well settled patent law that "obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some *teaching, suggestion, or motivation* to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art." *In re Fine*, 837 F.2d 1071, 5 U.S.P.Q.2d 1596 (Fed. Cir. 1988) (emphasis added) ; *In re Jones*, 958 F.2d 347, 21 U.S.P.Q.2d 1941 (Fed. Cir. 1992); *see also* MPEP § 2143.01 .

Furthermore, the fact that a reference or references can be combined or modified is not sufficient to establish obviousness. For example, the Federal Circuit held in *In re Mills*, 916 F.2d 680, 16 U.S.P.Q.2d 1430 (Fed. Cir. 1990), that the mere fact that combination or modification of a reference or references is possible does not establish obviousness of the resultant combination *unless the prior art also suggests* the desirability of the combination, *i.e.*, unless the prior art provides *motivation* to produce the resultant combination. *Mills*, 16 U.S.P.Q.2d at 1432; *see also* MPEP § 2143.01, page 2100-91.

Moreover, the Board of Patent Appeals and Interferences has held that the fact that the claimed invention is within the capabilities of one of ordinary skill in the art is not sufficient by

itself to establish obviousness. *Ex parte Levengood*, 28 U.S.P.Q.2d 1300 (BPAI 1993). Section 2143.01 of the MPEP explains the *Levengood* holding as follows:

A statement that modifications of the prior art to meet the claimed invention would have been "well within the ordinary skill of the art at the time the claimed invention was made" because the references relied upon teach that all aspects of the claimed invention were individually known in the art is not sufficient to establish a *prima facie* case of obviousness without some objective reason to combine the teachings of the references.

MPEP § 2143.01, page 2100-91 (emphasis in original).

Additionally, the consistent criteria for determination of obviousness is whether the prior art would have suggested to one of ordinary skill in the art that this process should be carried out and would have a reasonable likelihood of success, viewed in the light of the prior art. Both the suggestion and the expectation of success must be found in the prior art, not in the applicant's disclosure.

Appellants respectfully point out that not one of the references relied on by the Examiner provides a motivation for an electrochemical cell as claimed herein, and particularly as claimed in Claim 1. Accordingly, Appellants request that these rejections be overturned by the Board.

**B. Rejection of Claims as Obvious over Thackeray *et al.* (US 4,507,371)**

Claims 1, 3-4, 7-15 and 18-20 are rejected under 35 U.S.C. § 103 as being obvious over Thackeray *et al.* U.S. Patent No. 4,507,371 (the '371 patent). In particular, the Action asserts that the '371 patent shows a spinel lithium manganese dioxide with stabilizing cations. The Action further maintains that the anode and cathode of the '371 patent may be made with the spinel material and that the electrolyte may be one containing a lithium salt and a solvent. It is also stated that the cathode may contain a lithium transition metal oxide. The Action takes the

position that the invention would have been obvious to one having ordinary skill in the art because the artisan has sufficient skill to select the materials necessary for the voltage requirements needed. Appellants respectfully traverse.

The '371 patent is concerned with electrochemical cells having an anode and a cathode coupled together by a solid electrolyte, with each of the anode, cathode and electrolyte comprising a cubic close-packed framework structure having, as its base structural unit, a unit of the formula  $(B_2)X_4^{n-1}$  where  $(B_2)X_4$  is a structural unit of an  $A(B_2)X_4$  spinel. Although the '371 patent discloses that both the anode and cathode can be of spinel material, it deals with combinations of these components with non-spinel compounds in general fashion only. Furthermore, the only example in the '371 patent discloses a cell having a lithium anode (and not a lithium transition metal oxide spinel compound anode as claimed in the present invention), a spinel ( $LiMn_2O_4$ ) cathode and a liquid electrolyte comprising one molar  $LiBF_4$  in propylene carbonate. The present invention, on the other hand, requires that both the anode and the cathode comprise as at least part of their structure, a lithium metal oxide compound, that the lithium metal oxide compound of the anode have a spinel type framework structure and that the cell operate in a "rocking chair" fashion. Thus, it is clear that the '371 patent provides neither a teaching of, suggestion of, motivation for, nor reasonable expectation of success in producing the claimed invention *as a whole*. See *Gillette*, 919 F.2d at 724.

The Action contends that the invention as a whole would have been obvious to one having ordinary skill in the art at the time that the invention was made because the artisan has sufficient skill to select the materials necessary for the voltage requirements needed. Appellants respectfully submit that this argument is not well founded. To establish a *prima facie* case of

obviousness, the Examiner must provide logical reasoning or evidence to support his assumption that it would have been obvious to one of ordinary skill in the art to select the anode, cathode and electrolyte to provide a cell which operates in said "rocking chair" fashion. *See e.g., In re Vaeck*, 947 F.2d 488, 493, 20 U.S.P.Q.2d 1438 (Fed. Cir. 1991); MPEP § 2142, 2100-109 (1996). There is simply no teaching or suggestion in the '371 patent of such "rocking chair" operation. The fact that a skilled artisan has the ability to select materials is clearly not sufficient to establish a *prima facie* of obviousness. *See Levengood*, 28 U.S.P.Q.2d at 1301-1302; MPEP § 2143.01. Clearly, the only moving example provided in the '371 patent would not provide a rocking chair operation by virtue of the lithium metal anode. In the absence of any teaching or suggestion in the '371 patent of the "rocking chair" mechanism of the invention, it is submitted that no *prima facie* case for obviousness has been made.

Furthermore, it is not sufficient that the prior art discloses particular elements of the invention, i.e., an anode, a cathode and an electrolyte, but it must suggest the desirability, and thus the obviousness of making the claimed combination, i.e., the combination which results in the "rocking chair" effect. For a *prima facie* case of obviousness, the reference must thus at least suggest the combining of each of the elements in the claim to achieve the "rocking chair" effect. The motivation to combine the elements in such manner must be found in the prior art, not in Appellants' disclosure. *Vaeck*, 947 F.2d at 493; *see also Gillette*, 919 F.2d at 724. In light of the foregoing arguments, Appellants respectfully submit that the '371 patent does not at all provide the requisite motivation to modify its teachings to recreate the instantly claimed invention.

A finding of *prima facie* obviousness requires that the prior art reference reveals a reasonable expectation of success in producing the claimed invention, i.e., providing an

electrochemical cell having an anode, cathode and electrolyte as claimed, and which co-operate to produce a cell which operates in "rocking chair" fashion. Furthermore, there must be evidence in the prior art of such reasonable expectation of success. *Vaeck*, 947 F.2d at 493. Since the only example in the '371 patent involves a metallic lithium anode, one of skill in the art would clearly not expect the cell of the '371 patent to operate in "rocking chair" fashion. *Id.* Neither the required reasonable expectation of success nor the evidence thereof, to produce a cell operating in "rocking chair" fashion, is found in the '371 patent.

Contrary to the Examiner's assertions, it would not have been obvious to one of ordinary skill in the art at the time the invention was made to select a combination of an anode, a cathode and an electrolyte which operate to produce a cell operating in said "rocking chair" fashion. As discussed above, there is no motivation for such a cell in the '371 patent.

The rejection under § 103 based on the '371 patent amounts to a "picking and choosing" of certain parts of the reference while ignoring other aspects of it. The Federal Circuit has held that "it is impermissible within the framework of 35 U.S.C. § 103 to pick and choose from any one reference only so much of it as will support a given position to the exclusion of other parts necessary to the full appreciation of what such reference *fairly suggests* to one skilled in the art." *Bausch & Lomb, Inc. v. Barnes-Hind/Hydrocurve, Inc.*, 230 U.S.P.Q. 416, 419 (Fed. Cir. 1986) (quoting *In re Wesslau*, 353 F.2d 238, 241, 147 U.S.P.Q. 391, 393 (CCPA 1965)).

Clearly, the '371 patent does not at all teach the combination of features (i), (ii), (iii) and (iv) of Claim 1 as set out above. More specifically, the '371 patent does not teach a cell operating in "rocking chair" fashion. As indicated in the previous response, this "rocking chair" effect occurs when lithium ions are transported between two transition metal oxide electrodes as

discussed in the specification. The Action asserts that "[i]f the instant claims select the materials suggested by the prior art then a rocking chair cell would also result." The Action ignores the fact that, in the only specific example given in the '371 patent, the anode is lithium (and NOT a lithium transition metal oxide spinel compound) while the cathode is a spinel ( $\text{LiMn}_2\text{O}_4$ ). Clearly this would not, as one of skill in the art would recognize, result in the "rocking chair" cell of the claimed invention. The '371 patent simply does not teach or suggest the desirability or possibility of a rocking chair effect.

The Action appears to take the position that a "rocking chair" mechanism is an inherent part of the cell of the '371 patent. It is well settled that for a portion of an invention to be inherent in a prior art reference, the inherency must be established as a certainty. *Ethyl Molded Products Co. v. Betts Package Inc.*, 9 U.S.P.Q.2d 1001, 1032-33 (E.D. Ky 1988). It follows that probabilities or possibilities are not sufficient to establish inherency. In fact, the Court of Customs and Patent Appeals stated that "[t]he mere fact that a certain thing *may* result from a given set of circumstances is not sufficient." *Hansgird v. Kemmer*, 102 F.2d 212, 214, 40 U.S.P.Q. 665, 667 (CCPA 1939). In the present case, not only does the '371 patent fail to expressly provide a teaching of the rocking chair mechanism of the present invention, it fails to inherently establish the mechanism by a possibility or probability, much less, by more than a possibility or probability.

The obviousness rejection is also improper because the '371 patent should not be considered analogous art. That is, the '371 patent does not deal with the same problems solved by the claimed invention. The claimed invention is directed to providing a safe lithium cell containing no metallic lithium in the anode. In contrast, the cell exemplified in the '371 patent has an anode of lithium metal. The '371 patent would thus appear to, in effect, teach away from

the present invention because the cell exemplified therein would clearly exhibit the safety problems which the present invention was designed to avoid.

For the foregoing reasons, Appellants submit that the obviousness rejection based on the '371 patent is improper, and request that it be withdrawn.

**C. Rejection of Claims Over Thackeray *et al.* US 4,980,251**

Claims 1, 3-4 and 7-20 are rejected under 35 U.S.C. § 103 as being obvious over Thackeray *et al.* US Patent No. 4,980,251 (the '251 patent). Specifically, the Action asserts that the '251 patent teaches spinel compounds having the same structure as the spinel compounds of the claims. It is also stated that the spinel structure may comprise the anode and the cathode, that the cathode may be a transition metal oxide material and the anode may be a lithium or lithium alloy. According to the Action, the invention would have been obvious to one having ordinary skill in the art because the skilled artisan recognizes that the properties of the spinel material are a result of the type of metal inserted into the crystal structure.

The '251 patent is directed to a method of synthesizing an essentially single phase lithium manganese oxide having a specified formula and having a spinel type crystal structure. The resultant compound is said to be suitable for use as a cathode in an electrochemical cell of the Li/Li<sub>y</sub>MnO<sub>2</sub> type (col 1 lines 12/13) together with an anode comprising lithium or a suitable lithium-containing alloy (col 1 lines 13/14). The '251 patent thus deals in detail with the manufacture of a cathode for an electrochemical cell, and discloses only in broad outline the electrochemical cell and the anode therefor.

The Examiner is not correct in his statement that the '251 patent teaches that the spinel structure may be used for both the anode and the cathode. The passage quoted by the Examiner (col 2 lines 37 to 68) merely supports that the spinel structure can be used as a cathode in an electrochemical cell. Indeed, the '251 patent emphasizes that the compound in question has exceptional utility as a reversible or secondary cathode in an electrochemical cell - see col 7 line 61 to col 8 line 8. The '251 patent is totally silent regarding, and does not at all suggest, the use of the compound as an anode in an electrochemical cell. Indeed, the '251 patent only teaches, in relation to the anode, the use of lithium or a lithium containing alloy. It does thus not at all teach or suggest using as an anode a lithium transition metal oxide having a spinel type structure as claimed in the present invention. See *Vaeck*, 947 F.2d at 493; *Gillette*, 919 F.2d at 724. In fact, it appears that the '251 patent in effect teaches away from the present invention because it would exhibit the unsafe conditions that the present invention seeks to avoid.

The specific examples set forth in the '251 patent further support Appellants' interpretation of the teachings therein. For example, Figures 1 to 11 deal only with compounds, and Figures 13 to 15 relate to the use of a cell having both a cathode and an anode. The anode of the cell illustrated in Figures 13 to 15 is a metallic lithium anode (col 6 line 15). The '251 patent would thus not at all suggest to a person of ordinary skill in the art to use an anode as defined in Claim 1. It is unclear how one of skill in the art would be motivated to produce a cell having a lithium transition metal oxide compound as at least part of both the anode and the cathode with the anode having a spinel structure, in light of the teaching in the '251 patent only of cells possessing a metallic lithium or lithium alloy anode.

Furthermore, and importantly, the '251 patent does not at all teach or suggest the "rocking chair" effect which is the feature of integer (iv) of Claim 1 as set out in paragraph A.1 above, and which is crucial to the present invention as discussed above. It is the use of spinel material in the anode that contributes to causing the rocking chair effect. Since the anodes in the cells disclosed in the '251 patent are made of metallic lithium or a lithium alloy, it is clear that the cells taught therein would not exhibit the "rocking chair" effect required by the claims of the present invention. It is unclear how one of skill in the art would be motivated to produce the cell of the invention exhibiting a "rocking chair" mechanism from the teaching of a cell where only the cathode is a lithium manganese oxide having a spinel type structure and the anode is of the type that the present invention expressly seeks to avoid.

The Examiner's contention that the claimed invention is obvious over the '251 patent appears to be entirely speculative. In particular, the '251 patent does not suggest the claimed invention as a whole, does not suggest or provide an incentive to make the combination as claimed in Claim 1, does not provide motivation for a person of ordinary skill in the field of the art to make the combination as claimed in Claim 1, does not suggest the desirability and thus the obviousness of making the combination of Claim 1, does not provide a reasonable expectation of success in producing the cell of Claim 1, and does not form analogous art since it specifically teaches a cell having a metallic lithium anode which is what the presently claimed invention seeks to avoid. *See Vaeck*, 947 F.2d at 493.

For the foregoing reasons, Appellants submit that the obviousness rejection based on the '251 patent is improper, and request that it be withdrawn.

**D. Rejections of Claims as Obvious over Thackeray (US 5,316,877)**

Claims 1 and 3-20 are rejected under 35 U.S.C. § 103 as being obvious over Thackeray US Patent 5,316,877 (the '877 patent). In particular, the Action asserts that the '877 patent teaches a spinel material having two of the claimed structures, *i.e.*  $\text{Li}_2\text{Mn}_4\text{O}_9$  and  $\text{Li}_4\text{Mn}_5\text{O}_{12}$ . Although the Action admits that the '877 patent does not explicitly teach all of the valence numbers and characteristics of the materials, the Action nevertheless takes the position that the invention would have been obvious to one having ordinary skill in the art because the skilled artisan recognizes that the valence of each element depends on which elements are selected to make the crystal structure.

The '877 patent deals with a cathode for an electrochemical cell where the cathode comprises an electrochemically active compound of lithium, manganese and oxygen having a spinel type structure and having a specified formula. Similarly to the '251 patent discussed above, the '877 patent deals in detail with the cathode of an electrochemical cell and deals only in broad outline with the other components of the cell, particularly the anode and the electrolyte. In particular, the '877 patent teaches that the anode may be lithium metal, a lithium aluminum alloy, etc. It does not teach, either expressly or implicitly, that the anode may be a lithium transition metal oxide spinel compound as claimed in integer (i) of Claim 1 of the present case.

This fact is emphasized in the specific examples and figures of the '877 patent. In fact, all of the Figures of the '877 patent, with the exception of Figure 25, relate to cathodes. Similarly, all of Examples 1 to 10 relate to the manufacture of the cathode, and refer only to the anode as being lithium. When read together with the description of Figure 25 which relates to the test cell,

on page 15, it is clear that the '877 patent contains no teaching or suggestion of the use of a spinel compound as an anode, as required in integer (i) of Claim 1 of the present application.

As explained above, it is the presence of lithium metal oxides in both the anode and the cathode, and the spinel structure of the lithium metal oxide in at least the anode, that causes the cell of the invention to operate in the "rocking chair" fashion required by claim 1. Clearly a cell containing a compound having a spinel type structure only in the cathode, with a lithium metal or lithium metal alloy in the anode, as is taught in the '877 patent (and, incidentally, in the '251 patent) would not even have the ability to operate in a "rocking chair" fashion. Accordingly, the '877 patent also lacks any teaching or suggestion of the "rocking chair" effect required in integer (iv) of Claim 1, which has as a prerequisite the presence of the spinel compound of integer (i) in at least the anode. *See Vaeck*, 947 F.2d at 493.

It is thus respectfully submitted that this reference also does not at all teach or suggest the combination of integers (i) to (iv) of Claim 1 of the present application, as set out in Section A. above.

In summary, the '877 patent does not suggest the claimed invention as a whole, does not suggest or provide an incentive to make the combination as claimed in Claim 1, does not provide motivation for a person of ordinary skill in the field of the art to make the combination as claimed in Claim 1, does not suggest the desirability and thus the obviousness of making the combination of Claim 1, does not provide a reasonable expectation of success in producing the cell of Claim 1, and does not form analogous art since it specifically teaches a cell having a metallic lithium anode which is what the presently claimed invention seeks to avoid.

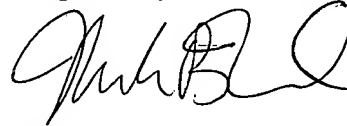
For the foregoing reasons, Appellants submit that the obviousness rejection based on the '877 patent is improper, and request that it be withdrawn.

#### **IX. CONCLUSION**

Appellants respectfully submit that, from the foregoing observations and arguments, the Action's conclusion that the claims are obvious is unwarranted. It is therefore requested that the Board overturn the Action's rejections.

Please date stamp and return the enclosed postcard to evidence receipt of this document.

Respectfully submitted,



Mark B. Wilson  
Reg. No. 37,259  
Attorney for Appellants

ARNOLD, WHITE & DURKEE  
P.O. Box 4433  
Houston, Texas 77057  
(512) 418-3000

Date: May 16, 1997

## APPENDIX A

1. An electrochemical cell, which comprises

as at least part of an anode, a lithium transition metal oxide compound which has a  $[B_2]X_4^{n-}$  spinel-type framework structure of an  $A[B_2]X_4$  spinel wherein A and B comprise metal cations selected from the group consisting of Li, Ti, V, Mn, Fe and Co with the proviso that at least one of A and B comprises Li and at least one of A and B comprises Ti, V, Mn, Fe and/or Co, X is oxygen (O), and n- refers to the overall charge of the structural unit  $[B_2]X_4$  of the framework structure, and the transition metal cation of which in the fully discharged state of the cell has a mean oxidation state greater than +3 for Ti, +3 for V, +3.5 for Mn, +2 for Fe and +2 for Co;

as at least part of a cathode, a lithium metal oxide compound; and

an electrically insulative, lithium containing, liquid or polymeric, ionically conductive electrolyte between the anode and the cathode, such that, on discharging the cell, lithium ions are extracted from the spinel-type framework structure of the anode, with the oxidation state of the metal ions of the anode thereby increasing, while a concomitant insertion of lithium ions into the compound of the cathode takes place, with the oxidation state of the metal ions of the cathode decreasing correspondingly.

3. A cell according to Claim 1 wherein, in the compound of the anode, B is a single transition metal cation.

4. A cell according to Claim 1 wherein, in the compound of the anode, B is a mixture of different transition metal cations.

5. A cell according to Claim 1, wherein the compound of the anode is a stoichiometric spinel selected from the group consisting of  $\text{Li}_4\text{Mn}_5\text{O}_{12}$ , which can be written as  $(\text{Li})_{8a}[\text{Li}_{0,33}\text{Mn}_{1,67}]_{16d}\text{O}_4$  in ideal spinel notation;  $\text{Li}_4\text{Ti}_5\text{O}_{12}$ , which can be written as  $(\text{Li})_{8a}[\text{Li}_{0,33}\text{Ti}_{1,67}]_{16d}\text{O}_4$  in ideal spinel notation;  $\text{LiTi}_2\text{O}_4$  which can be written as  $(\text{Li})_{8a}[\text{Ti}_2]_{16d}\text{O}_4$  in ideal spinel notation;  $\text{LiV}_2\text{O}_4$ , which can be written as  $(\text{Li})_{8a}[\text{V}_2]_{16d}\text{O}_4$  in spinel notation; and  $\text{LiFe}_5\text{O}_8$ , which can be written as  $(\text{Fe})_{8a}[\text{Fe}_{1,5}\text{Li}_{0,5}]_{16d}\text{O}_4$  in ideal spinel notation.

6. A cell according to Claim 1, wherein the compound of the anode is a defect spinel selected from the group consisting of  $\text{Li}_2\text{Mn}_4\text{O}_9$ , which can be written as  $(\text{Li}_{0,89}\square_{0,11})_{8a}[\text{Mn}_{1,78}\square_{0,22}]_{16d}\text{O}_4$  in spinel notation; and  $\text{Li}_2\text{Ti}_3\text{O}_7$ , which can be written as  $(\text{Li}_{0,85}\square_{0,15})_{8a}[\text{Ti}_{1,71}\text{Li}_{0,29}]_{16d}\text{O}_4$  in spinel notation.

7. A cell according to Claim 1, wherein the compound of the anode is a lithium-iron-titanium oxide having a spinel-type structure and in which A comprises lithium and iron cations, while B comprises lithium, iron and titanium cations.

8. A cell according to Claim 1 wherein, in the compound of the anode, the  $[\text{B}_2]\text{X}_4$  framework structure contains, within the framework structure or within interstitial spaces present in the framework structure, additional metal cations to the lithium ions and the other A and B cations to stabilize the structure, with the additional metal cations being present in an amount less than 10 atomic percent.

9. A cell according to Claim 1, wherein the lithium metal oxide compound of the cathode also has a spinel-type framework structure.

10. A cell according to Claim 9, wherein the framework structure of the lithium metal oxide compound of the cathode has as its basic structural unit, a unit of the formula  $[\text{B}_2]\text{X}_4^{n-}$ ,

wherein  $[B_2]X_4^{n-}$  is the structural unit of an  $A[B_2]X_4$  spinel, with the X anions being arranged to form a negatively charged anion array, and wherein

A comprises a lithium cation;

B comprises at least one metal cation;

X is oxygen (O); and

n- refers to the overall charge of the structural unit  $[B_2]X_4$  of the framework structure, with the transition metal cations of the anode being more electropositive than those of the cathode.

11. A cell according to Claim 10 wherein, in the compound of the cathode, B is a single metal cation.

12. A cell according to Claim 10 wherein, in the compound of the cathode, B is a mixture of different metal cations.

13. A cell according to Claim 10, wherein the compound of the cathode is a spinel in which the B cation is selected from the group consisting of Li, Mn, Co and Ni.

14. A cell according to Claim 10 wherein, in the compound of the cathode, the  $[B_2]X_4$  framework structure contains, within the framework structure or within interstitial spaces present in the framework structure, additional metal cations to the lithium ions and the other A and B cations to stabilize the structure, with the additional metal cations being present in an amount less than 10 atomic percent.

15. A cell according to Claim 14, wherein the compound of the cathode is  $\text{Li}_{1+\delta}\text{Mn}_{2-\delta}\text{O}_4$  where  $0 < \delta \leq [0,1]0.1$ .

16. A cell according to Claim 14, wherein the compound of the cathode is  $\text{LiM}_{\delta/2}\text{Mn}_{2-\delta}\text{O}_4$  where  $\text{M}=\text{Mg}$  or  $\text{Zn}$  and  $0 < \delta \leq [0,05]0.05$ .

17. A cell according to Claim 1, wherein the lithium metal oxide compound of the cathode has a layered structure conforming to the formula  $\text{Li}_x\text{Co}_{1-y}\text{Ni}_y\text{O}_2$  where  $0 < x \leq 1$  and  $0 \leq y \leq 1$ .

18. A cell according to Claim 1, wherein the anode compound offers a voltage of 3V or less against pure lithium, while the cathode compound offers a voltage of between 3V and 4.5V against pure lithium.

19. A cell according to Claim 1, wherein the electrolyte is a room temperature electrolyte selected from the group consisting of  $\text{LiClO}_4$ ,  $\text{LiBF}_4$ , and  $\text{LiPF}_6$  dissolved in an organic solvent selected from the group consisting of propylene carbonate, ethylene carbonate, dimethyl carbonate, dimethoxyethane and mixtures thereof.

20. A cell according to Claim 1, wherein the electrolyte is a polymeric electrolyte selected from the group consisting of polyethylene oxide (PEO) -  $\text{LiClO}_4$ , PEO -  $\text{LiSO}_3\text{CF}_3$  and PEO -  $\text{LiN}(\text{CF}_3\text{SO}_2)_2$ .